$$d = \frac{\lambda}{n(\sin\alpha + \sin\beta)},$$

where λ is the nominal free-space wavelength for which said enhanced volume phase grating is designed,

$\alpha + \beta = 2\theta$ and

$$2\theta = \text{either } a\cos\left(\frac{2p-1}{2s-1}\right) \text{ degrees or } 180 - a\cos\left(\frac{2p-1}{2s-1}\right) \text{ degrees,}$$

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where s and p are integers and s > p > 0,

and said peak modulation, Δn, of said bulk refractive index is obtained from the following equation:

$$\Delta n = \frac{\lambda}{T}\left(\frac{2s-1}{2}\right)\sqrt{C_R C_S},$$

where $C_R = \cos\alpha$ and $C_S = \cos\alpha - \frac{\lambda}{nd}\tan\left(\frac{\beta-\alpha}{2}\right)$;

values of said bulk refractive index, n, and said peak modulation, Δn, being established using well known exposure and processing procedures for said volume phase medium;

whereby the S-polarization diffraction efficiency and the P-polarization diffraction efficiency of said enhanced volume phase grating, when illuminated by an incident beam of said nominal free-space wavelength, λ, at an internal angle of incidence, α, are simultaneously maximized at a common value of the product ΔnT, thereby simultaneously minimizing insertion loss and PDL in a highly dispersive volume phase grating.

10. The enhanced volume phase grating of claim 9 wherein said volume phase medium is dichromated gelatin.

11. The enhanced volume phase grating of claim 9 wherein said index modulation, Δn, of said volume phase medium is greater than 0.1, and preferably on the order of 0.2, thereby decreasing Bragg angle sensitivity.

12. The enhanced volume phase grating of claim 9 wherein said rigid support means is a transparent medium, such as glass or fused silica, and said transparent cover means is a similar or identical transparent medium.

13. The enhanced volume phase grating of claim 12 further including a reflective means to reflect the diffracted beam back toward and into said enhanced volume phase grating.

14. The enhanced volume phase grating of claim 12 wherein the external surfaces of said transparent medium and said transparent cover means are coated with an anti-reflection coating such that the overall loss for the S-polarized light and the overall loss for the P-polarized light are minimized and substantially equal at said nominal free-space wavelength.

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15. The enhanced volume phase grating of claim 12 wherein the external surfaces of said transparent medium and said transparent cover means are coated with an anti-reflection coating such that the overall loss for the S-polarized light is somewhat greater than the overall loss for the P-polarized light at said nominal free-space wavelength, thereby minimizing the worst case PDL.

16. The enhanced volume phase grating of claim 12 wherein the external surfaces of said transparent medium and said transparent cover means are coated with an anti-reflection coating such that the overall loss for the S-polarized light is somewhat greater than the overall loss for the P-polarized light after two passes through said enhanced volume phase grating at said nominal free-space wavelength, thereby minimizing the worst case PDL in a two-pass design.

REMARKS

Applicant thanks the examiner for the careful attention accorded the present application. Applicant is especially appreciative of the constructive criticism regarding the clarity of the claims. Accordingly, the applicant has re-written the claims in a manner that enhances the clarity of the claims and provides a recipe for constructing applicant's invention.

Applicant submits that new Claim 9 now provides a clear and simple recipe for making an Enhanced Volume Phase Grating (E-VPG) of the present invention for any given or selected wavelength, as will be shown in the following paragraphs. The new claim 9 now also describes the physical structure of the invention rather than its function. Therefore, claim 9 now satisfies the requirements of 35 U.S.C. 112, first and second paragraphs, in that it is enabling, and defines the subject matter of the invention.